

ANURAN SPECIES RICHNESS IN THE DEPARTAMENTO PANDO, BOLIVIA

J. Moravec¹, J. Aparicio², M. Guerrero-Reinhard³, & G. Calderón⁴

¹ Department of Zoology, National Museum, 11579 Praha 1, Czech Republic

² Museo Nacional de Historia Natural – Colección Boliviana de Fauna, Casilla 8706, La Paz, Bolivia

³ Universidad Amazónica de Pando, Centro de Investigación y Preservación de la Amazonía,
Av. 9 de Febrero No. 001, Cobija, Bolivia

⁴ Universidad Amazónica de Pando, Centro de Investigación y Preservación de la Amazonía,
Av. 9 de Febrero No. 001, Cobija, Bolivia

ABSTRACT

An updated list of anuran species of the Bolivian Departamento Pando is provided. The list contains 114 species belonging to 13 families. One species (*Dendropsophus brevifrons*) is recorded for the first time from Bolivia. Three other species (*Dendropsophus* cf. *nanus*, *Pristimantis olivaceus* and *Trachycephalus coriaceus*) are recorded for the first time within the territory of the Departamento Pando.

Key words: Amphibia, Anura, species list, new country record, Departamento Pando, Bolivia.

INTRODUCTION

The Departamento Pando represents the northernmost region of Bolivia. It is situated in the southwestern Amazonian basin, within the zone of tall evergreen lowland rainforest. Results of recent herpetological investigations of this region show that lowland Bolivian Amazonia harbors an unusually rich anuran fauna containing still unrecorded and undescribed species (see e.g., Cadle & Reichle 2000, Köhler & Lötters 2001, Cadle & Guerrero 2003, Cadle *et al.* 2003, Padial *et al.* 2004, Reichle 2007, Padial & De la Riva 2009, Angulo & Icochea 2010). Since the available lists of amphibian species of the Departamento Pando (Köhler & Lötters 1999, De la Riva *et al.* 2000) were compiled ten years ago, an updated overview of the anuran species recorded from Pando is needed.

MATERIAL AND METHODS

Own investigations on anuran species diversity of the Departamento Pando were conducted between 1999 and 2008. We thoroughly surveyed 16 localities, selected to cover all main regions of the Departamento (Fig. 1). Many other localities were sampled occasionally during various short-term collecting trips. This work has already resulted in several publications (Moravec & Aparicio 2004a,b, 2005, 2006; Moravec *et al.* 2006, 2008, 2009; Castroviejo-Fisher *et al.* 2011). For the purpose of this overview we combined all our published and still unpublished faunal records with literature data into an updated list of anuran species of the Departamento Pando. Key references providing basic information about the occurrence of the listed species in Pando were included in the list. Notes on several new or biogeographically interesting records are summarized in a separate account. Voucher specimens as well as photo vouchers are deposited in the Colección Boliviana de Fauna (CBF) and the National Museum

¹ Corresponding author: e-mail: jiri.moravec@nm.cz

Prague (NMP6V – voucher specimens, NMP6F – photo vouchers).

RESULTS

The updated list of anuran species known to occur in the Departamento Pando (see Appendix I) contains 114 species belonging to 13 families (Aromobatidae 3, Bufonidae 8, Centrolenidae 3, Ceratophryidae 1, Dendrobatidae 5, Hemiphractidae 1, Hylidae 53, Leiuperidae 2, Leptodactylidae 18, Microhylidae 7, Pipidae 1, Ranidae 1, Strabomantidae 11).

New records are listed and commented below.

Centrolenidae

Vitreorana oyampiensis (Lescure, 1975)

Material: CBF 6408–09, NMP6V 74060/1–3

Six males of *V. oyampiensis* (Fig. 2A) were collected in the surroundings of the settlement of San Antonio (11°18'S, 67°23'W; c. 200 m a.s.l.) on 23 November 2007. Until now the species has been recorded from

the Guiana region, Colombia, Ecuador, Peru and Brazil (Frost 2009, Guayasamin *et al.* 2009). Cisneros-Heredia & McDiarmid (2007) mentioned the presence of *V. oyampiensis* (as *Cochranella ametarsia*) also in Bolivia, but they did not provide any exact locality. The finding of Muñoz & Aguayo (2009) can be regarded as the first Bolivian country record (Reserva de Vida Silvestre Bruno Racua, provincia Federico Román, Departamento Pando). Thus we provide the second vouchered record of *V. oyampiensis* for Bolivia, lying c. 250 km SW of the first locality. The collected specimens were calling from dense vegetation covering very damp swampy shores of a small stream running through undisturbed *terra firme* forest.

Hylidae

Dendropsophus brevifrons (Duellman & Crump, 1974)

Photo vouchers: NMP6F 11–13.

This first record of *D. brevifrons* for Bolivia is based on three voucher photographs of an adult specimen

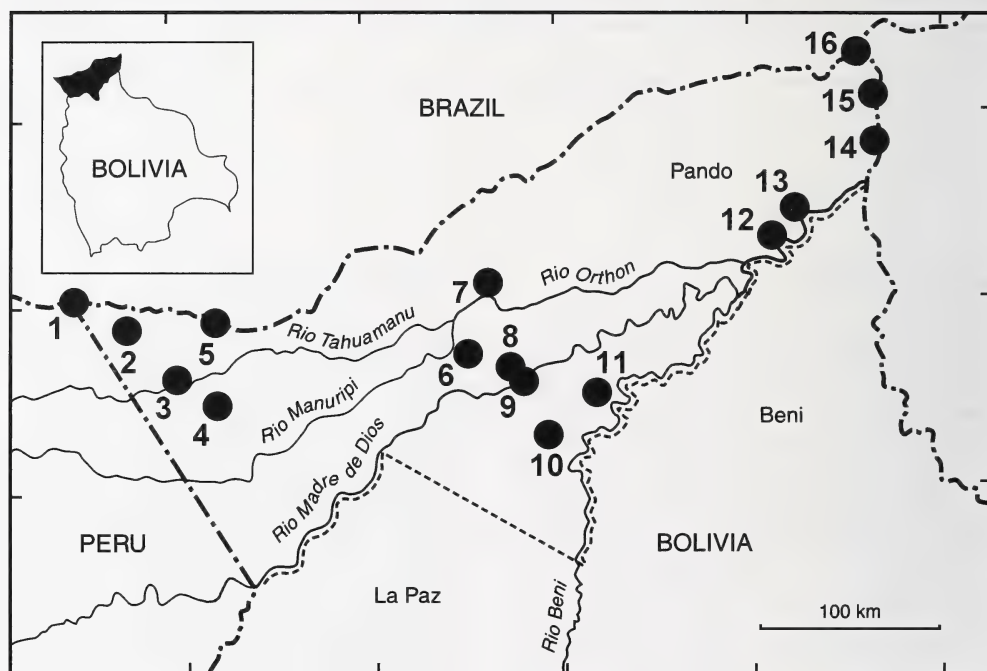


FIG. 1. Schematic map of the Departameto Pando showing the main localities investigated:

(1) Bolpebra, 10°57'S, 69°34'W; (2) Bioceanica, 11°08'S, 69°22'W; (3) Tahuamanu, 11°24'S, 69°01'W; (4) San Antonio, 11°29'S, 68°52'W; (5) Cobija, 11°02'S, 68°45'W; (6) San Antonio, 11°18'S, 67°23'W; (7) Nacebe, 11°00'S, 67°25'W; (8) Sacrificio, 11°23'S, 67°18'W; (9) Sena, 11°29'S, 67°15'W; (10) Canadá, 11°45'S, 67°08'W; (11) Barracón, 11°33'S, 66°56'W; (12) Santa Crucito, 10°44'S, 65°54'W; (13) Palmira, 10°35'S, 65°44'W; (14) Caimán, 10°14'S, 65°23'W; (15) Manoa, 9°41'S, 65°24'W; (16) Piedritas, 9°57'S, 65°20'W.

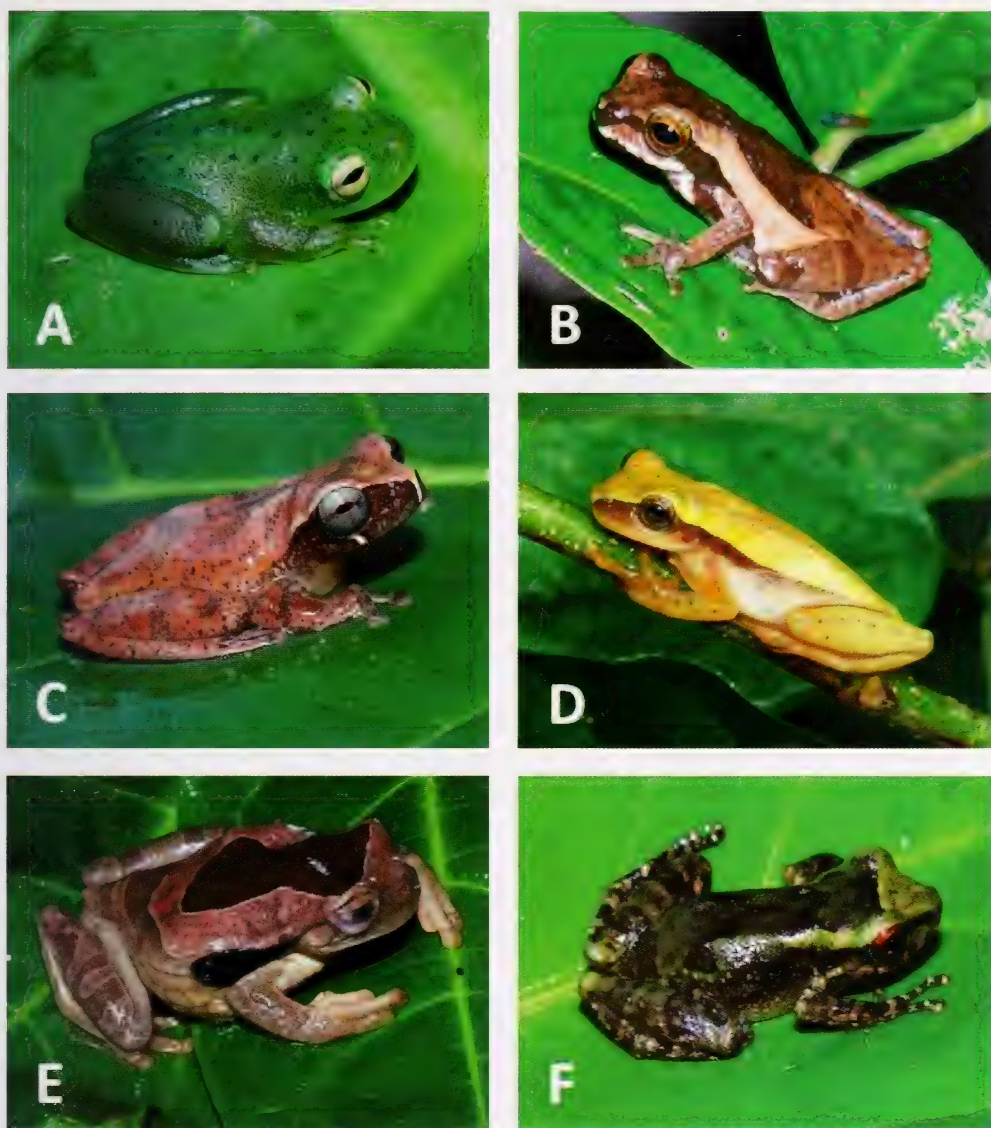


FIG. 2. (A) *Vitreorana oyampiensis*, San Antonio; (B) *Dendropsophus brevifrons*, Tahuamanu; (C) *Dendropsophus koechlini*, Sacrificio; (D) *Dendropsophus* cf. *nanus*, Laguna Murillo; (E) *Trachycephalus coriaceus*, San Antonio; (F) *Pristimantis olivaceus*, San Antonio.

obtained by M. Guerrero-Reinhard and G. Calderón in the area of the Estación Biológica Tahuamanu de la UAP (11°24'S, 69°01'W; c. 280 m a.s.l.) on 1 April 2005 (Fig. 2B). The species is widely distributed in the Guianan region as well as the Central and Upper Amazon basin (Frost 2009), and its occurrence in Bolivia was predicted by De la Riva *et al.* (2000) and Köhler (2000).

Dendropsophus koechlini (Duellman & Trueb, 1989)
Material: CBF 6395, NMP6V 74061

In Bolivia *D. koechlini* was known from the Departamentos Beni, La Paz, and Santa Cruz (De la Riva *et al.* 2000). Recently, Reichle (2007) reported this species also from the south-westernmost corner of the Departamento Pando (settlement of Chivé). Here we record the finding of *D. koechlini* (Fig. 2C)

in the vicinity of the settlement of Sacrificio (11°23'S, 67°18'W; c. 180 m a.s.l.), which extends the known range of this species c. 200 km NE to the central Pando. At his locality, several calling males were found in a dense flooded forest on 21 November 2007.

Dendropsophus cf. nanus (Boulenger, 1889)

Photo vouchers: NMP6F 14–15.

Our record is based on two voucher photographs (Fig. 2D) taken by M. Guerrero-Reinhard in the area of Laguna Murillo (c. 11°11'S, 66°50'W; c. 150 m a.s.l.) on 15 November 2004. *Dendropsophus nanus* is known from the Bolivian Departamentos Beni and Santa Cruz (De la Riva *et al.* 2000) where it is common in open habitats. In the Departamento Beni dense populations of this species were observed around Riberalta along the border with the Departamento Pando (Moravec & Aparicio 2000). The only record of *D. nanus* for the Departamento Pando (Fugler 1984) was questioned by Köhler & Lötters (1999). Nevertheless, our finding provides further evidence of the occurrence of this (or related morphologically similar) species in this Department.

Trachycephalus coriaceus (Peters, 1867)

Material: CBF 6420, NMP6V 74062

Two voucher specimens were collected in the surroundings of the settlements San Antonio (11°18'S, 67°23'W; c. 200 m a.s.l.) and San Antonio (11°29'S, 68°52'W; c. 270 m a.s.l.) (Fig. 2E) on 22–26 November 2007. Both individuals were found in disturbed primary forest. In Bolivia, this species was previously known only from Puerto Almacén, in the Department of Santa Cruz (De la Riva 1990, De la Riva *et al.* 2000).

Strabomantidae

Pristimantis olivaceus (Köhler, Morales, Lötters, Reichle & Aparicio, 1998)

Material: CBF 6415–16, NMP6V 74067–68

This species (Fig. 2F) was known from the Bolivian Departamentos Cochabamba and Santa Cruz and from the Peruvian region of Madre de Dios (Köhler *et al.* 1998, Frost 2009). Thus, our records from the surroundings of the settlements of Palmira (10°35'S, 65°44'W; c. 150 m a.s.l.) and San Antonio (11°29'S, 68°52'W; 270 m a.s.l.) made on 18–27 November 2007 fill the gap between the known localities. All

collected specimens were males calling from trees c. 10 m above the ground in disturbed primary forest.

DISCUSSION

The updated list of anuran species of the Departamento Pando comprises 114 species (some still awaiting definitive identification). This number more than doubles most recent species lists for the region (Köhler & Lötters 1999, De la Riva *et al.* 2000). Nevertheless, if we take into account the high anuran diversity of the more thoroughly surveyed area of Cuzco Amazónico in neighboring Peru (see Duellman 2005), and the high number of species predicted to occur within the territory of Pando (see De la Riva *et al.* 2000, Köhler 2000, Lötters *et al.* 2007, Reichle 2007), we can expect that our knowledge of anuran richness of the Departamento Pando remains still incomplete (see also Dahl *et al.* 2009). This is in agreement with our current finds of other anuran forms representing candidates for new species, e.g., a member of the *Leptodactylus marmoratus* group, which might be associated with one of three cryptic species (so called “Forest Call II”) recognized by Angulo *et al.* (2003) in Tambopata Reserved Zone in Peru, or 2–3 different *Scinax* forms identified in Pando by M. Guerrero-Reinhard and M. Jansen (unpublished data).

Considering the number of the known species and those expected to occur in Pando we estimate its anuran richness at c. 150 species. Moreover, recent DNA barcoding work shows that the number of anuran species in the Guianan and Amazonian regions is highly underestimated and up to 115% additional species may be expected among Neotropical amphibians in lowland rainforest (Fouquet *et al.* 2007). Thus, the real anuran diversity in the Departamento Pando is probably much higher than our current estimation.

The high anuran richness in the Departamento Pando can be seen in light of its geographic position in south-western Amazonia. In this territory, different faunal elements (species widespread in the Amazon basin, upper Amazonian species, south-western Amazonian species, species of peri-Andean forest, lower Amazonian species as well as *cerrado* and *Chaco* species) meet together and form biogeographically heterogeneous anuran communities. Therefore the amphibian fauna of the Departamento Pando deserves long-term thorough research and effective protection.

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REFERENCES

- Angulo, A., & J. Icochea. 2010. Cryptic species complexes, widespread species and conservation: lessons from Amazonian frogs of the *Leptodactylus marmoratus* group (Anura: Leptodactylidae). *Systematics and Biodiversity* 8: 357-370.
- Angulo, A., C. Cocroft, R.B., & S. Reichle. 2003. Species identity in the genus *Adenomera* (Anura: Leptodactylidae) in southern Peru. *Herpetologica* 59: 490-504.
- Cadle, J.E., & M. Guerrero. 2003. Amphibians and reptiles. Pp. 71-73, 93-94 in Alverson, W.S. (ed.). *Bolivia: Pando, Madre de Dios, Rapid biological inventories: 05*. The Field Museum, Chicago.
- Cadle, J.E., & S. Reichle. 2000. Reptiles and amphibians. Pp. 34-36, 66-68 in Alverson, W.S., Moskovits, D.K., & J.M. Shopland (eds.). *Bolivia: Pando, Bio Tahuamanu, Rapid biological inventories: 01*. The Field Museum, Chicago.
- Cadle, J.E., Gonzáles, L., & M. Guerrero. 2003. Amphibians and reptiles. Pp. 41-45, 122-124 in Alverson, W.S., Moskovits, D.K., & I.C. Halm (eds.). *Bolivia: Pando, Federico Román, Rapid biological inventories: 06*. The Field Museum, Chicago.
- Castroviejo-Fisher, S., Moravec, J., Aparicio, J., Guerrero-Reinhard, M., & G. Calderón. 2011. DNA taxonomy reveals two new species records of *Hyalinobatrachium* (Anura: Centrolenidae) for Bolivia. *Zootaxa* 2798: 64-68.
- Cisneros-Heredia, D.F., & R.W. McDiarmid. 2007. Revision of characters of Centrolenidae (Amphibia: Anura: Athesphatanura), with comments on its taxonomy and the description of new taxa of glassfrogs. *Zootaxa* 1572: 1-82.
- Dahl, Ch., Novotny, V., Moravec, J., & S.J. Richards. 2009. Beta diversity of frogs in the forests of New Guinea, Amazonia and Europe: contrasting tropical and temperate communities. *Journal of Biogeography* 36: 896-904.
- De la Riva, I. 1990. Lista preliminar comentada de los anfibios de Bolivia, con datos sobre su distribución. *Bollettino del Museo regionale di Scienze naturali, Torino* 8: 261-319.
- De la Riva, I., Köhler, J., Lötters, S., & S. Reichle. 2000. Ten years of research on Bolivian amphibians: updated Checklist, distribution, taxonomic problems, literature and iconography. *Revista Española de Herpetología* 14: 19-164.
- Duellman, W.E. 2005. *Cusco Amazónico. The lives of amphibians and reptiles in an Amazonian rainforest*. Ithaca, NY.
- Fouquet, A., Gilles, A., Vences, M., Marty, C., Blanc, M., & N.J. Gemmell. 2007. Underestimation of species richness in Neotropical frogs revealed by mtDNA analyses. *PLoS ONE*, 2, e1109, doi: 10.1371/journal.pone.0001109.
- Frost, D.R. 2009. Amphibian species of the world: an online reference. Version 5.3 (12 February, 2009). Available from <http://research.amnh.org/herpetology/amphibia/> (accessed 22 February 2010)
- Fugler, C.M. 1984. Tercera contribución a la fauna herpetológica del oriente boliviano. *Ecología en Bolivia* 5: 63-72.
- González, L.A., & S. Reichle. 2004. Seis primeras citas y datos sobre la biología de siete especies de anuros (Amphibia: Anura) para Bolivia. *Revista Boliviana de Ecología y Conservación Ambiental* 15: 93-99.
- Guayasamin, J.M., Castroviejo-Fisher, S., Trueb, L., Ayarzagüena, J., Rada, M., & C. Vilà. 2009. Phylogenetic systematics of Glassfrogs (Amphibia: Centrolenidae) and their sister taxon *Allophryne ruthveni*. *Zootaxa* 2100: 1-97.
- Jansen, M., Vidoz, J.Q., & O. Helmig. 2008. *Hypsiboas albopunctatus* (Spotted treefrog). *Herpetological Review* 39: 106.
- Jungfer, K.-H., Reichle, S., & O. Piscurek. 2010. Description of a cryptic southwestern Amazonian species of leaf-gluing treefrog, genus *Dendropsophus* (Amphibia: Anura: Hylidae). *Salamandra* 46: 202-213.
- Köhler, J. 2000. Amphibian diversity in Bolivia: a study with special reference to montane forest regions. *Bonner zoologische Monographien* 48: 1-241.
- Köhler, J., & S. Lötters. 1999. Annotated list of amphibian records from the Departamento Pando, Bolivia, with description of some advertisement calls. *Bonner zoologische Beiträge* 48: 259-273.
- Köhler, J., & S. Lötters. 2001. A new species of minute *Hyla* from the southwestern Amazon basin (Amphibia, Anura, Hylidae). *Studies on Neotropical Fauna and Environment* 36: 105-112.
- Köhler, J., Morales, V.R., Lötters, S., Reichle, S., & J. Aparicio. 1998. A new green species of frog, genus *Eleutherodactylus*, from Bolivia and Perú (Amphibia, Anura, Leptodactylidae). *Studies on Neotropical Fauna and Environment* 33: 93-99.
- Lötters, S., & J. Köhler. 2000. A new toad of the *Bufo typhonius* complex from humid montane forest of Bolivia (Amphibia, Anura, Bufonidae). *Spixiana* 23: 293-303.
- Lötters, S., De la Riva, I., Reichle, S., & G. Soto. 2000. First record of *Bufo guttatus* (Amphibia: Bufonidae)

- from Bolivia, with notes on *Bufo glaberrimus*. Bonner zoologische Beiträge 49: 75-78.
- Lötters, S., Jungfer, K.-H., Henkel, F.W., & W. Schmidt. 2007. Poison frogs. Biology, species & captive husbandry. Edition Chimaira, Frankfurt am Main.
- Maldonado, M., & S. Reichle. 2007. Primer registro de *Ranitomeya biolat* (Morales, 1992) (Anura: Dendrobatidae) para Bolivia, con apuntes sobre la nueva nomenclatura de Dendrobatidae. Kempffiana 3: 14-17.
- Moravec, J., & J. Aparicio. 2000. Amphibians and reptiles recently recorded from the surroundings of Riberalta (Departamento Beni, Bolivia). Časopis Národního Muzea, Řada Přírodovědná 169: 1-15.
- Moravec, J., & J. Aparicio. 2004a. First record of *Hyla triangulum* Günther, 1869 from Bolivia. Herpetozoa 17: 90.
- Moravec, J., & J. Aparicio. 2004b. Notes on the herpetofauna of Nacebe (Provincia Abuna, Departamento Pando, Bolivia). Časopis Národního Muzea, Řada Přírodovědná 173: 13-28.
- Moravec, J., & J. Aparicio. 2005. Notes on the herpetofauna of Bioceanica and Bolpebra (Provincia Nicolas Suárez, Departamento Pando, Bolivia). Časopis Národního Muzea, Řada Přírodovědná 174: 95-113.
- Moravec, J., & J. Aparicio. 2006. First record of *Atractus latifrons* (Günther, 1868) from Bolivia (Serpentes: Colubridae). Časopis Národního Muzea, Řada Přírodovědná 175: 13-16.
- Moravec, J., Aparicio, J., & J. Köhler. 2006. A new species of tree frog, genus *Dendropsophus* (Anura: Hylidae), from the Amazon of northern Bolivia. Zootaxa 1327: 23-40.
- Moravec, J., Aparicio, J., Guerrero-Reinhard, M., Calderón, G., & J. Köhler. 2008. Diversity of small Amazonian *Dendropsophus* (Anura: Hylidae): another new species from northern Bolivia. Zootaxa 1918: 1-12.
- Moravec, J., Aparicio, J., Guerrero-Reinhard, M., Calderón, G., Jungfer, K.-H., & V. Gvoždík. 2009. A new species of *Osteocephalus* (Anura: Hylidae) from Amazonian Bolivia: first evidence of tree frog breeding in fruit capsules of the Brazil nut tree. Zootaxa 2215: 37-54.
- Muñoz, A. 2008. *Hemiphysalus scutatus* (Spix's Horned treefrog). Herpetological Review 39: 233.
- Muñoz, A., & R. Aguayo. 2009. Sobre la presencia de *Vitreorana oyampiensis* (Lescure, 1975) (Amphibia: Centrolenidae) en Bolivia. Cuadernos de Herpetología 23: 97-99.
- Padial, J.M., & I. De la Riva. 2005. First record of *Hydro-laetare schmidti* (Cochran & Goin, 1959) for Bolivia and new distributional data of Bolivian anurans. Herpetozoa 18: 65-66.
- Padial, J.M., Gonzáles, L., Reichle, S., Aguayo, R., & I. De la Riva. 2004. First records of five species of the genus *Eleutherodactylus* Duméril and Bibron, 1841 (Anura, Leptodactylidae) for Bolivia. Graellsia 60: 167-174.
- Padial, J.M., & I. De la Riva. 2009. Integrative taxonomy reveals cryptic Amazonian species of *Pristimantis* (Anura: Strabomantidae). Zoological Journal of the Linnean Society 155: 97-122.
- Reichle, S. 2007. Distribution, diversity and conservation status of Bolivian amphibians. Unpublished Ph.D. thesis, University of Bonn, Germany.

APPENDIX 1. List of anuran species known to occur in the Departamento Pando, Bolivia.

Taxon	Key references
Aromobatidae	
<i>Allobates trilineatus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Allobates</i> cf. <i>femoralis</i>	Cadle & Reichle (2000), De la Riva <i>et al.</i> (2000), Moravec & Aparicio (2005)
<i>Allobates</i> sp.	Köhler & Lötters (1999) ¹ , Cadle & Guerrero (2003) ¹
Bufonidae	
<i>Rhaebo guttatus</i>	De la Riva <i>et al.</i> (2000), Lötters <i>et al.</i> (2000)
<i>Rhinella</i> cf. <i>acutirostris</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000), Lötters & Köhler (2000)
<i>Rhinella castaneotica</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Rhinella granulosa</i>	De la Riva <i>et al.</i> (2000)
<i>Rhinella marina</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Rhinella poeppigii</i>	Moravec & Aparicio (2005)
<i>Rhinella</i> sp. I (<i>margaritifera</i> complex)	Cadle <i>et al.</i> (2003), Moravec & Aparicio (2005)
<i>Rhinella</i> sp. II (<i>margaritifera</i> complex)	Cadle <i>et al.</i> (2003), Moravec & Aparicio (2005)
Centrolenidae	
<i>Hyalinobatrachium mondolfii</i>	Castroviejo-Fisher <i>et al.</i> 2011
<i>Hyalinobatrachium munozeorum</i>	Castroviejo-Fisher <i>et al.</i> 2011
<i>Vitreorana oyampiensis</i>	Cisneros-Heredia & McDiarmid (2007) ² , Muñoz & Aguayo (2009)
Ceratophryidae	
<i>Ceratophrys cornuta</i>	Cadle & Reichle (2000)
Dendrobatidae	
<i>Ameerega hahneli</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Ameerega picta</i>	Moravec & Aparicio (2006)
<i>Ameerega trivittata</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Adelphobates quinquevittatus</i>	Cadle <i>et al.</i> (2003)
<i>Ranitomeya biolat</i>	Maldonado & Reichle (2007)
Hemiphractidae	
<i>Hemiphractus scutatus</i>	Muñoz (2008)
Hylidae	
<i>Dendropsophus acrocanus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Dendropsophus brevifrons</i>	This paper
<i>Dendropsophus joannae</i>	Köhler & Lötters (2001)
<i>Dendropsophus juliani</i>	Moravec <i>et al.</i> (2006)
<i>Dendropsophus koechlini</i>	Reichle (2007), this paper

APPENDIX 1. Continued.

Taxon	Key references
<i>Dendropsophus leali</i>	Moravec & Aparicio (2005)
<i>Dendropsophus leucophyllatus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Dendropsophus marmoratus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Dendropsophus minutus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Dendropsophus</i> cf. <i>nanus</i>	This paper
<i>Dendropsophus parviceps</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Dendropsophus rhodopeplus</i>	Moravec & Aparicio (2005)
<i>Dendropsophus riveroi</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Dendropsophus reichlei</i>	Moravec <i>et al.</i> (2008)
<i>Dendropsophus sallii</i>	Jungfer <i>et al.</i> (2010)
<i>Dendropsophus sarayacuensis</i>	De la Riva <i>et al.</i> (2000)
<i>Dendropsophus schubarti</i>	De la Riva <i>et al.</i> (2000)
<i>Dendropsophus triangulus</i>	Moravec & Aparicio (2004a,b)
<i>Dendropsophus xapuriensis</i>	Moravec & Aparicio (2005)
<i>Dendropsophus</i> sp.	Moravec <i>et al.</i> (2008)
<i>Hypsiboas albopunctatus</i>	Jansen <i>et al.</i> (2008)
<i>Hypsiboas boans</i>	Cadle & Guerrero (2003)
<i>Hypsiboas calcaratus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Hypsiboas cinerascens</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Hypsiboas fasciatus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Hypsiboas geographicus</i>	Cadle & Reichle (2000)
<i>Hypsiboas lanciformis</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Hypsiboas punctatus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Hypsiboas raniceps</i>	Reichle (2007)
<i>Osteocephalus buckleyi</i>	Cadle <i>et al.</i> (2003)
<i>Osteocephalus castaneicola</i>	Moravec <i>et al.</i> (2009)
<i>Osteocephalus taurinus</i>	Cadle & Guerrero (2003)
<i>Osteocephalus</i> sp. (A)	Köhler & Lötters (1999) ³ , De la Riva <i>et al.</i> (2000) ³
<i>Osteocephalus</i> sp. (B)	Moravec & Aparicio (2004a), Moravec <i>et al.</i> (2009)
<i>Phyllomedusa atelopoides</i>	González & Reichle (2004)
<i>Phyllomedusa bicolor</i>	Cadle & Reichle (2000), De la Riva <i>et al.</i> (2000)
<i>Phyllomedusa camba</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Phyllomedusa palliata</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Phyllomedusa tomopterna</i>	Cadle <i>et al.</i> (2003)
<i>Phyllomedusa vaillantii</i>	Cadle & Reichle (2000)
<i>Pseudis paradoxa</i>	Moravec & Aparicio (2004)
<i>Scarthyla goinorum</i>	De la Riva <i>et al.</i> (2000)
<i>Scinax chiquitanus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Scinax garbei</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Scinax ictericus</i>	González & Reichle (2004)
<i>Scinax nebulosus</i>	Moravec & Aparicio (2004)
<i>Scinax</i> cf. <i>fuscomarginatus</i>	Moravec & Aparicio (2006) ⁴ , Jansen (unpubl. data)

APPENDIX 1. Continued.

Taxon	Key references
<i>Scinax pedromedinae</i>	Moravec & Aparicio (2004)
<i>Scinax ruber</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Sphaenorhynchus lacteus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Trachycephalus coriaceus</i>	This paper
<i>Trachycephalus resinifictrix</i>	Cadle & Reichle (2000), De la Riva <i>et al.</i> (2000)
<i>Trachycephalus typhonius</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
Leiuperidae	
<i>Edalorbina perezii</i>	Gonzáles & Reichle (2004), Moravec & Aparicio (2005)
<i>Engystomops freibergi</i>	Cadle & Reichle (2000)
Leptodactylidae	
<i>Leptodactylus bolivianus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Leptodactylus discodactylus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Leptodactylus didymus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Leptodactylus elenae</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Leptodactylus fuscus</i>	Cadle & Guerrero (2003)
<i>Leptodactylus hylaedactylus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Leptodactylus knudseni</i>	Reichle (2007)
<i>Leptodactylus</i> cf. <i>labyrinthicus</i>	Cadle <i>et al.</i> (2003)
<i>Leptodactylus leptodactyloides</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Leptodactylus lineatus</i>	Cadle <i>et al.</i> (2003)
<i>Leptodact.</i> cf. <i>macrosternum</i>	Köhler & Lötters (1999) ⁵ , Cadle <i>et al.</i> (2003) ⁵
<i>Leptodactylus pentadactylus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Leptodactylus petersi</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Leptodactylus podicipinus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Leptodactylus rhodomystax</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Leptodactylus rhodonotus</i>	Cadle & Reichle (2000)
<i>Leptodactylus simonstuarti</i>	Angulo & Icochea (2010)
<i>Leptodactylus</i> sp. I	Köhler & Lötters (1999) ⁶ , De la Riva <i>et al.</i> (2000) ⁶
Microhylide	
<i>Altigius alios</i>	Gonzáles & Reichle (2004)
<i>Chiasmocleis bassleri</i>	Cadle <i>et al.</i> (2003), Gonzáles & Reichle (2004)
<i>Chiasmocleis ventrimaculata</i>	Cadle <i>et al.</i> (2003)
<i>Chiasmocleis</i> sp.	Cadle <i>et al.</i> (2003)
<i>Ctenophryne geayi</i>	Gonzáles & Reichle (2004)
<i>Elachistocleis helianneae</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Hamptophryne boliviana</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
Pipidae	
<i>Pipa pipa</i>	Moravec & Aparicio (2004), Padial & De la Riva (2005)

APPENDIX 1. Continued.

Taxon	Key references
Ranidae	
<i>Lithobates palmipes</i>	Reichle (2007)
Strabomantidae	
<i>Oreobates cruralis</i>	Padial <i>et al.</i> (2004)
<i>Oreobates quixensis</i>	Cadle & Reichle (2000), De la Riva <i>et al.</i> (2000)
<i>Pristimantis altamazonicus</i>	Padial <i>et al.</i> (2004)
<i>Pristimantis fenestratus</i>	Köhler & Lötters (1999), De la Riva <i>et al.</i> (2000)
<i>Pristimantis ockendeni</i>	Padial <i>et al.</i> (2004)
<i>Pristimantis olivaceus</i>	This paper
<i>Pristimantis reichlei</i>	Cadle & Reichle (2000) ⁷ , Moravec & Aparicio (2005) ⁷ , Padial & De la Riva (2009)
<i>Pristimantis skydmainos</i>	Padial <i>et al.</i> (2004)
<i>Pristimantis toftae</i>	Padial <i>et al.</i> (2004)
<i>Pristimantis ventrimarmoratus</i>	De la Riva <i>et al.</i> (2000)
<i>Pristimantis zimmermanae</i>	Padial <i>et al.</i> (2004)

¹ identified as *Colostethus* sp.² identified as *Cochranella ametarsia*³ identified as *Osteocephalus leprieurii*⁴ identified as *Scinax parkeri*⁵ identified as *Leptodactylus chaquensis/macrosternum*⁶ identified as *Adenomera andreae*⁷ identified as *Eleutherodactylus danae* or *E. cf. danae*